Title: The emergence of time in neural circuits and behavior

Abstract: Spontaneous behavior in animals and humans shows a striking amount of variability both in the spatial domain (which actions to choose) and temporal domain (when to act). Concatenating actions into sequences and behavioral plans reveals the existence of a hierarchy of timescales ranging from hundreds of milliseconds to minutes. How does such a complex spatiotemporal structure emerge from neural circuits dynamics?

In this talk, I will present recent results from experiments and theory suggesting a computational mechanism generating the temporal variability underlying naturalistic behavior. I will show how neural activity from the motor cortex of rats unfolds through temporal sequences of attractors, which predict the intention to act. These sequences naturally emerge from recurrent cortical networks, and correlated fluctuations play a crucial role in explaining the variability in action timing. We will then discuss how cortical circuits can control their information-processing speed via neuromodulation or perturbation. Finally, we will investigate the emergence of hierarchies of timescales in neural circuits using recurrent networks with chaotic dynamics.